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Impact of ICT Infrastructure on Academic Staff Productivity: Evidence from Eastern Technical University, Sierra Leone

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Abstract

This study examined the impact of Information and Communication Technology (ICT) infrastructure on the productivity of academic staff at Eastern Technical University (ETU), Sierra Leone. Guided by three objectives: to examine the availability and types of ICT infrastructure, to assess the extent of its utilization, and to evaluate its impact on teaching, research, and related activities, the study adopted a descriptive survey design. Data were collected from forty-nine academic staff using a structured, five-point Likert-scale questionnaire and analyzed with descriptive statistics (frequencies and percentages) in SPSS and Microsoft Excel. The findings reveal a clear paradox. Availability of ICT infrastructure was limited and inconsistent, with unreliable electricity and the absence of digital learning platforms (both 44.9% disagreement) identified as the weakest areas, while utilization was moderate to low and fewer than half of respondents (44.9%) reported adequate ICT skills. In sharp contrast, an overwhelming majority affirmed that ICT strongly enhances productivity improved teaching effectiveness (91.9%), faster task completion (91.8%), and improved overall job performance (89.8%). Respondents also strongly affirmed persistent barriers, including unreliable internet connectivity (83.7%), inadequate training (85.7%), and lack of technical support (83.7%). The study concludes that although staff clearly recognize the value of ICT, its realization is constrained by infrastructural, skills-related, and support-related gaps. It recommends targeted investment in reliable electricity and internet, deployment of digital learning platforms, regular capacity-building, and a dedicated technical support unit.

Keywords: ***ICT infrastructure; academic staff productivity; higher education; Technology Acceptance Model; Sierra Leone***

1. Introduction

Information and Communication Technology (ICT) infrastructure refers to the interconnected system of hardware, software, communication networks, and digital platforms that enable the processing, storage, and exchange of information within an organization. In higher education, it encompasses computers, internet services, learning management systems, digital libraries, and collaborative tools that support teaching, research, and administrative activities [1]. Academic staff productivity, in turn, refers to the efficiency and effectiveness with which lecturers and researchers discharge their professional duties, including teaching, research, publication, student supervision, and community engagement, typically measured through outputs such as teaching quality, publication volume, research impact, and institutional contribution.

The relationship between ICT infrastructure and productivity is well established: ICT tools widen access to information, reduce manual effort, and streamline communication, thereby raising efficiency. A recent study at Eastern Technical University (ETU) found a significant positive relationship between computer literacy and job performance, indicating that digital competence improves efficiency, accuracy, timeliness, and adaptability among staff [2]. Globally, the diffusion of ICT accelerated by the COVID-19 pandemic has shifted higher education from conventional classroom methods toward more flexible, interactive, and technology-

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centered practice, improving teaching effectiveness and research output [3], [4]. Emerging tools such as artificial intelligence further reshape academic work, improving writing quality, time management, and conceptual understanding, though their effectiveness depends heavily on reliable underlying infrastructure [5].

In Sub-Saharan Africa, adoption of ICT in higher education has grown, but its depth varies widely across institutions. Limited access to computers, inadequate internet connectivity, unreliable electricity, and insufficient training remain major barriers that hinder staff from integrating technology into teaching and research [6], [7]. The result is an ICT productivity paradox in which sizeable investment does not translate proportionally into measurable output, because the enabling conditions for effective use are absent [8]. Sierra Leone typifies this pattern: national efforts to integrate ICT into universities are constrained by financial, technical, and institutional limitations, and persistent challenges of power, connectivity, facilities, and technical support undermine effective use.

At ETU specifically, ICT infrastructure supports academic and administrative functions, and the university has provided computer laboratories, internet access, and digital learning tools. Yet evidence indicates that limited access to computers, unreliable power, poor connectivity, inadequate training, and weak institutional support continue to restrict effective use [2]. Crucially, most prior work in this setting has examined students or administrative personnel, leaving the productivity of academic staff who are central to teaching and research comparatively under-studied. This study addresses that gap. It is guided by three objectives: (i) to examine the availability and types of ICT infrastructure at ETU; (ii) to assess the extent to which academic staff utilize that infrastructure; and (iii) to evaluate its impact on academic staff productivity in teaching, research, and related activities.

2. Literature Review

This section synthesizes the theoretical and empirical literature on ICT infrastructure and academic staff productivity, organized around the study's three objectives, and makes explicit the gap the present study fills.

2.1. Theoretical Framework

The study is anchored in two complementary theories. The Technology Acceptance Model (TAM) holds that adoption of a technology is driven principally by perceived usefulness and perceived ease of use, which shape attitudes, intention, and ultimately actual use [9]. Applied to higher education, TAM explains why staff who regard ICT tools as useful and easy to operate integrate them into teaching, research, and communication, while tools perceived as complex or unreliable are under-adopted regardless of availability. The Diffusion of Innovation (DOI) theory complements this individual-level view with a systemic account of how innovations spread through a social system over time, mediated by relative advantage, compatibility, complexity, trialability, and observability, and by adopter categories ranging from innovators to laggards [10]. Together, TAM and DOI provide micro and macro-level lenses: productivity gains depend not only on the presence of infrastructure but also on favorable perceptions, digital competence, and institutional conditions that enable sustained use. This framing extends related unified accounts of acceptance that add facilitating conditions and social influence to the core determinants [11].

2.2. Availability of ICT Infrastructure

Availability of resources such as computers, connectivity, digital platforms, and access to online databases is a precondition for technology integration [1]. Institutions with well-developed infrastructure report measurable gains in academic productivity and institutional performance, as high-speed connectivity, digital

libraries, and learning management systems support more effective teaching and efficient research [12]. Availability is uneven, however, and in much of the Global South, limited access, poor connectivity, unreliable power, and constrained funding are recurrent barriers [13], [14]. Within institutions, disparities across departments, ageing equipment, and weak maintenance further erode the effectiveness of what exists [15]. Empirical work at ETU echoes these patterns, identifying limited computer access, unreliable electricity, and poor connectivity as principal constraints on availability [2].

2.3. Utilization of ICT Infrastructure

Utilization the extent to which available resources are actually used is the critical link between provision and productivity. Staff with higher digital competence are consistently more likely to integrate technology into teaching and research, whereas limited skills lead to shallow use confined to word processing and browsing [16]. Beyond frequency, the depth and quality of use matter: basic tasks yield limited returns, whereas advanced use supports interactive teaching, online research, and international collaboration, substantially enhancing performance. Utilization is further shaped by training, attitudes, institutional support, and the reliability of power and connectivity, all of which are frequently deficient in developing contexts [2], [17].

2.4. Impact of ICT on Academic Staff Productivity

The literature widely documents a positive impact of ICT on productivity through improved efficiency, information access, collaboration, and innovation in teaching and research [1], [18]. Yet the magnitude of this impact is conditioned by availability and effective utilization; where infrastructure and skills are weak, the potential is only partially realized [8], [14]. At ETU, ICT competence has been shown to improve job performance via efficiency, accuracy, timeliness, and adaptability, confirming that impact is real but constrained [2]. The uniqueness of the present study lies in its explicit focus on academic staff productivity rather than students or administrators within the ICT-infrastructure context of a young Sierra Leonean university, examining availability, utilization, and impact together.

3. Methodology

The study adopted a descriptive survey design, appropriate for systematically describing existing conditions and perceptions without manipulating variables, and well suited to structured, quantifiable data amenable to statistical analysis. The study was conducted at Eastern Technical University, a public, multi-campus institution in Kenema District, Eastern Region, Sierra Leone, established from the transformation of Eastern Polytechnic under the Universities Act of 2021 and offering programmes across six faculties.

The population comprised all academic staff at Eastern Technical University, including assistant lecturers, lecturers, and senior lecturers, estimated at between 150 and 200. Using the Yamane formula for sample size determination at a 5% precision level and an assumed population of 180, an adequate sample size of approximately 124 was indicated [20]. A stratified random sampling technique was used, dividing the population by faculty and drawing respondents proportionally to ensure cross-faculty representation. In practice, forty-nine (49) valid and complete questionnaires were retrieved and analyzed; these form the basis of the results reported below.

The primary instrument was a structured questionnaire dominated by closed-ended, five-point Likert items (Strongly Agree to Strongly Disagree) covering the availability, utilization, and impact of ICT. Content validity was established through expert review by the supervisor and staff of the Information Technology and Computer Science Department. Reliability was assessed through a pilot study, yielding a Cronbach's alpha of

0.72, which is acceptable for internal consistency [21]. Both primary data (from the questionnaire) and secondary data (published and unpublished literature) were used.

Completed questionnaires were checked for completeness, coded, and entered into SPSS and Microsoft Excel. Data were analyzed using descriptive statistics frequencies, percentages, and tabulation and interpreted in relation to the research questions. Ethical standards were observed throughout: informed consent was obtained from all participants, participation was voluntary, and confidentiality and anonymity were preserved, with no identifying information collected. All 49 respondents (100%) consented before completing the questionnaire.

4. Results

Results are reported objectively following the structure of the study objectives, beginning with the respondent profile and proceeding to availability, utilization, and impact. For each construct, the proportion agreeing (Agree and Strongly Agree combined) is reported alongside disagreement and neutrality.

4.1. Respondent Profile

The 49 respondents were predominantly male (33; 67.3%) and relatively young, with 71.4% below 41 years of age. A majority held postgraduate qualifications, and most had five years or fewer of service, consistent with the university's recent establishment. Respondents were drawn from all six faculties, with Engineering and Innovation the most represented. Table 1 summarizes the demographic profile.

Table 1. Demographic profile of respondents (n = 49).

Characteristic	Category	Freq.	%
Gender	Male	33	67.3
	Female	16	32.7
Age (years)	20–30	14	28.6
	31–40	21	42.9
	41–50	12	24.5
	51 & above	2	4.1
Qualification	Bachelor's	18	36.7
	Master's	24	49.0
	M.Phil	1	2.0
	PhD	3	6.1
	Other	3	6.1
Experience (years)	< 2	8	16.3
	2–5	28	57.1
	6–10	12	24.5
	> 10	1	2.0
Faculty	Engineering & Innovation	14	28.6
	Entrepreneurship & Management	10	20.4
	Education	10	20.4

Characteristic	Category	Freq.	%
	Health Sci. & Disaster Management	7	14.3
	Pure & Applied Sciences	4	8.2
	Vocational & Skills Dev.	4	8.2

Source: Field survey, 2026.

4.2. Availability of ICT Infrastructure

No availability item was affirmed by a clear majority, indicating that the university's ICT infrastructure is limited and inconsistent (Table 2). Access to computers was almost evenly split (42.9% agreement against 36.7% disagreement), and internet accessibility was equally divided (36.7% each). The availability of digital learning platforms and the reliability of the electricity supply emerged as the two weakest areas, each attracting 44.9% disagreement. These perceptions were reinforced by strong affirmation of the corresponding barriers: 83.7% reported that internet connectivity is unreliable, 77.6% that the electricity supply disrupts ICT usage, and 73.5% that ICT facilities are insufficient.

Table 2. Availability of ICT infrastructure (% of respondents).

Statement	Agree	Neutral	Disagree
Computers are available for academic use	42.9	20.4	36.7
Internet services are accessible	36.7	26.5	36.7
Digital learning platforms are available	32.7	22.4	44.9
ICT facilities are adequate	36.7	30.6	32.7
Electricity supply is reliable for ICT use	34.7	20.4	44.9

Note. "Agree" and "Disagree" combine the respective Strongly Agree/Agree and Strongly Disagree/Disagree responses. Source: Field survey, 2026.

4.3. Utilization of ICT Infrastructure

Utilization was moderate to low across all functions, with affirmed use ranging from about 35% to 43% (Table 3). Use was highest for lecture preparation (42.9%) and lowest for communicating with students (34.7%) the latter closely linked to the limited availability of digital platforms reported above. Fewer than half of respondents (44.9%) judged their own ICT skills adequate. The associated barriers were affirmed emphatically: 85.7% reported that ICT training is inadequate the single strongest barrier in the study and 83.7% that a lack of technical support affects usage.

Table 3. Utilization of ICT and related barriers (% of respondents).

Statement	Agree	Neutral	Disagree
I use ICT tools for lecture preparation	42.9	28.6	28.6
I use ICT for research and academic writing	36.7	30.6	32.7
I use digital platforms to communicate with students	34.7	28.6	36.7
I use ICT for academic collaboration	38.8	28.6	32.7
I have adequate ICT skills for my work	44.9	24.5	30.6
ICT training is inadequate (barrier)	85.7	6.1	8.2
Lack of technical support affects usage (barrier)	83.7	6.1	10.2

Note. Source: Field survey, 2026.

4.4. Impact of ICT on Academic Staff Productivity

In sharp contrast to availability and utilization, the perceived impact of ICT on productivity was overwhelmingly positive (Table 4). More than 85% of respondents agreed that ICT improves teaching effectiveness (91.9%), research productivity (89.8%), and speed of task completion (91.8%), academic collaboration (85.7%), and overall job performance (89.8%). Task completion recorded the highest agreement of any item in the study, with 69.4% strongly agreeing, strongly supporting the perceived-usefulness dimension of the Technology Acceptance Model.

Table 4. Perceived impact of ICT on academic staff productivity (% of respondents).

Statement	Agree	Neutral	Disagree
ICT improves my teaching effectiveness	91.9	4.1	4.1
ICT increases my research productivity	89.8	6.1	4.1
ICT helps me complete tasks faster	91.8	6.1	2.0
ICT enhances academic collaboration	85.7	12.2	2.0
ICT improves my overall job performance	89.8	8.2	2.0

Note. Source: Field survey, 2026.

5. Discussion

The central result is a paradox. Academic staff overwhelmingly perceive ICT as beneficial to their productivity, yet both the availability and the utilization of ICT infrastructure remain limited. This mirrors the wider ICT productivity paradox, in which investment fails to convert proportionally into output because the enabling conditions for effective use are absent [8]. Interpreted through the Technology Acceptance Model, the attitudinal foundation for adoption is already firmly in place: perceived usefulness is uniformly high [9]. What is lacking is the perceived-ease-of-use dimension and the facilitating conditions that sustain use reliable power and connectivity, functional digital platforms, adequate skills, training, and technical support [11].

The Diffusion of Innovation perspective clarifies why uptake is uneven [10]. Where trialability and observability are curtailed by unreliable electricity and connectivity, staff cannot consistently experience the advantages of ICT, and diffusion slows regardless of favorable attitudes. The strongest barriers identified inadequate training (85.7%), unreliable internet (83.7%), and absent technical support (83.7%) operate precisely on ease of use and facilitating conditions rather than on motivation. The findings are consistent with evidence from comparable Global South contexts, where infrastructural and skills constraints repeatedly blunt the impact of otherwise valued technology [13], [14], and they corroborate prior ETU evidence linking computer literacy to job performance [2]. The binding constraints on productivity at the university are therefore structural rather than motivational, and addressing them offers the most direct route to converting recognized value into measurable gains.

6. Conclusion

Academic staff at Eastern Technical University strongly recognize the positive impact of ICT infrastructure on their productivity, yet the realization of this potential is significantly constrained by infrastructural, skills-related, and support-related gaps. Because the attitudinal foundation for adoption is already secure, the priority is to build the enabling environment that converts positive perceptions into consistent, productive use. Accordingly, the university and its partners should: improve electricity reliability through backup and alternative sources such as solar systems and standby generators; strengthen internet bandwidth and

campus-wide coverage; acquire and deploy a learning management system and other digital platforms; institute continuous, structured ICT training to raise digital literacy and confidence; establish a dedicated technical support unit for timely maintenance and troubleshooting; expand and modernize computers and laboratories with equitable distribution across faculties; develop a costed ICT policy with secured funding; and monitor and evaluate ICT availability, utilization, and impact so that investment is evidence-led. The study was limited to a single institution and relied on self-reported, quantitative data from 49 respondents; future research could extend the scope through comparative, mixed-methods, and inferential designs that explain and test the availability–utilization–impact paradox across several universities.

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Conflict of Interest

The authors declare no conflict of interest.

Data Availability Statement

The anonymized survey data supporting the findings of this study are available from the corresponding author upon reasonable request.

AI Usage Disclosure

The authors used a generative AI assistant for language editing and for formatting the manuscript to the journal template; all content was reviewed and verified by the authors. No AI tool is listed as an author.

Author Contributions

Conceptualization, S.A.K. and J.K.; methodology, J.K., L.B., and S.A.K; formal analysis, L.B. and J.K; investigation, J.K. and S.A.K.; writing original draft, J.K.; writing review and editing, all authors. All authors have read and agreed to the published version of the manuscript.

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